Ministry of Economic Development
Manatū Ōhanga
Intellectual Property Office of New Zealand

PCT/NZ03/00191



# CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 30 August 2002 with an application for Letters Patent number 521094 made by Desmond Kenneth BULL and Christopher James ALLINGTON.

I further certify that pursuant to a claim under Section 24(1) of the Patents Act 1953, a direction was given that the application proceed in the name of HOLMES SOLUTIONS LIMITED.



Dated 15 September 2003.



Neville Harris

Neville Harris
Commissioner of Patents, Trade Marks and Designs



330 High Street, Lower Hutt and 17 Toop Street, Seaview
PO Box 30687, Lower Hutt, New Zealand or DX SX 11129, Wellington

SUBSTITUTION OF APPLICANT
UNDER SECTION 24

Patents Form No. 4

Patents Act 1953

PROVISIONAL SPECIFICATION

# APPARATUS FOR TESTING TENSION OF ELONGATED FLEXIBLE MEMBER

We, Desmond Kenneth BULL, a New Zealand citizen of 19 Thornwood Place, Redwood, Christchurch, New Zealand and Christopher James ALLINGTON, a New Zealand citizen of 118 Roker Street, Somerfield, Christchurch, New Zealand, do hereby declare this invention to be described in the following statement:

The present invention relates to apparatus for testing the tension of elongated flexible members such as wires (including, but not limited to, fencing wires, agricultural and horticultural support wires, power wires and telephone wires), wire ropes, mesh fencing and ropes. For the sake of brevity and convenience, the term "wire" will be used herein to include all elongated flexible members.

There are many applications in which it is desirable to be able to check the tension of a wire whilst the wire is in use, without removing or damaging the wire. For example, if the wire strands of a fence or the support wires in a vineyard are strained too tightly, the wire will be damaged and is likely to fracture prematurely. However, if the wires are under strained, they will not form an effective fence or support the vines correctly.

At present, the only apparatus commonly used for checking tension of a wire in situ is a hand-held device which is hooked over the wire to be tested, and the wire to be tested is deflected by a preset distance. The deflected wire pushes downwards on a coil spring, deflecting a pointer connected to the spring over a scale. The degree of deflection gives a rough indication of the wire tension. Unfortunately this apparatus is awkward to use, since the reading must be made when the apparatus is actually in position on the wire, and also is notoriously inaccurate:- it is known to read with errors of up to 300 percent.

It is therefore an object of the present invention to provide an apparatus which can be used for checking the tension of a wire in situ with a greatly improved level of accuracy, and which is convenient to use.

The present invention provides apparatus for checking the tension of a wire, comprising: a support having rigidly secured thereto two pegs spaced apart in a direction substantially

parallel to the length of the wire; a spring mounted on said support between said two pegs, said spring and said pegs being arranged such that a wire passing in a predetermined path over and/or under said spring and said pegs is deflected from its normal position and exerts a pressure on said spring in a predetermined direction; a strain gauge or load cell associated with said spring so as to measure the pressure exerted on said spring when a wire is in said predetermined path; preprogrammed computing means electrically connected to said strain gauge or load cell and arrange to display a reading for the tension upon said wire when said spring has a pressure exerted thereon.

Preferably, said pegs are arranged to lie displaced vertically in the same vertical plane, with the spring between them. In use, a wire to be tested passes under the lower peg and over the upper peg, and presses downwards on the upper surface of the spring. However, many alternative arrangements are possible, since the only requirement is that the wire to be tested can be deflected around the pegs and press the spring in a predetermined direction. For example, both pegs could lie parallel in the same vertical plane with the spring between the pegs but vertically above the pegs, and wire to be tested could be arranged to pass under the first peg, over the top of the spring and under the second peg.

As used herein, the term "peg" includes a protrusion, a notch, a hook or similar connector or a slot.

By way of example only, a preferred embodiment of the present invention is described in detail with reference to the accompanying drawings, in which:-

Figure 1 is a plan view of apparatus in accordance with the present invention;

Figure 2 is a side view of the apparatus of figure 1, in use; and

Figure 3 is a view of part of figure 2, on a larger scale.

Referring to the drawings, apparatus 2 in accordance with the present invention comprises a support 3 formed with a handle 4 at one end, and supporting two spaced pegs 5,6, a spring 7, and an electronic read out 8 mounted in a housing 9.

The support 3 comprises a long hollow bar the major portion of which is straight but the handle end 3a of which is inclined at an acute angle to the major portion of the bar. Each end of the bar is closed by a plastic plug (not shown) of known type. The handle end 3a of the bar has electric batteries 10 for powering the electronic read out 8 mounted inside. The handle 4 is a simple "bicycle grip" type handle made of rubber or plastics material, which is a push fit over the handle end 3a of the bar.

The pegs 5,6 both are mounted on one side face of the support 3, widely spaced apart along the length of the support. Peg 5 is mounted adjacent the outer end of the support (i.e. the end furthest from the handle end 3a), close to the lower side 11 of the support. Peg 6 is mounted close to the handle end 3a of the support, adjacent the upper side 12 of the support.

The spring 7 comprises a strip of spring steel, one portion of which is rigidly secured to the top of the housing 9, leaving the other portion 13 of the spring projecting unsupported from the top of the housing. The free end of the portion 13 is curved downwards slightly, to prevent the spring from snagging on a wire being tested. The top of the housing 9 slopes at an acute angle to the length of the support 3, so that the spring 7 also slopes at an acute angle to the length of the support 3, with the highest point of the spring (just

before the downwardly curved portion) lying just below the upper side 12 of the support 3 and the upper surface of the peg 6. Advantageously, the spring 7 is kept below the upper side 12 of the support 3, to protect the spring from damage.

A strain gauge 14 is secured to the underside of the portion 13 of the spring 7; the strain gauge 14 is electrically connected to the read out 8 by wires 14a extending through an aperture in the side of the housing 9. The strain gauge 14 is arranged to measure the strain on the lower surface of the spring 7; thus, the greater the deflection of the spring 7 in the direction of Arrow A, the greater the reading on the strain gauge.

The apparatus of the present invention measures the tension in a wire by measuring the force required to deflect the wire. In use, the apparatus is arranged so that the wire 15 whose tension is to be measured lies underneath the peg 5 and over the top of the peg 6, so that the wire 15 presses on the upper surface of the portion 13 of the spring 7, deflecting the portion 13 in the direction of Arrow A. The greater the tension in the wire, the more force will be required to deflect it to pass under/over the pegs 5 and 6, and thus the greater the deflection of the spring 7.

The length of the portion of the wire which is deflected (i.e. the distance between the peg 5 and the peg 6) is not critical, providing the length remains constant from one test to the next, and providing the length is known when calculating the reference figures as described below. Obviously, if the length of the portion of wire is very long, there will be a relatively low force on the spring 7, which will tend to reduce the accuracy of the readings. Conversely, if the length of the portion of wire is very short, there will be a high force on the spring 7 but it may be difficult to manipulate the wire over/under the pegs because of the stiffness of the wire. For testing the tension in fencing and horticultural wires, a

support 3 which provides 500 mm between the centres of pegs 5 in 6 has been found to be a convenient length.

The read out 8 comprises a surface mounted circuit board which incorporates programmable integrated circuits, a screen 8a from which the user can read a figure for the wire tension, and a three function button 16 which can be used to switch the apparatus on and off, to clear the screen and zero the readings, and to scroll through a list of the available wire types for which the apparatus is programmed, and to select the required type.

The data from which the integrated circuits are programmed are obtained experimentally by testing multiple samples of each type of wire with which the apparatus is to be used, to obtain a series of readings for wire tension/strain gauge voltage. The test figures for each set of samples are averaged to give a set of reference figures for wire tension/strain gauge voltage for each type of wire with which the apparatus is to be used. These reference figures are then programmed into the integrated circuit such that when the apparatus is preset for a specified type of wire, the strain gauge reading is automatically converted to a wire tension reading which can be read directly off the screen.

It is envisaged that the apparatus typically would carry data for at least eight different types of commonly used wire. However, the apparatus could be re-calibrated as necessary for different applications.

The screen can be arranged to record each reading until the display is zeroed by the user. Thus, the apparatus can be used to measure the tension in a wire and then removed from the wire and lowered or raised to a convenient reading height for the user to read from the

screen, without losing the reading. The screen reading shows the wire type for which the apparatus is set, including the diameter of the wire. The screen reading also shows the optimal tension for that type of wire. This figure is based on the manufacturers recommendations. Further, the screen shows the actual tension of the wire being tested. Thus, the user can compare the tension of the wire being tested with the optimal tension recommended by the manufacturer, for every test being made.

All of the electrical/electronic components in the apparatus are waterproofed.
The support 3 and the housing 9 may be made of any suitable robust, impact resistant material e.g. anodized aluminium, coated steel, fibre reinforced resins or an impact resistant plastics material.

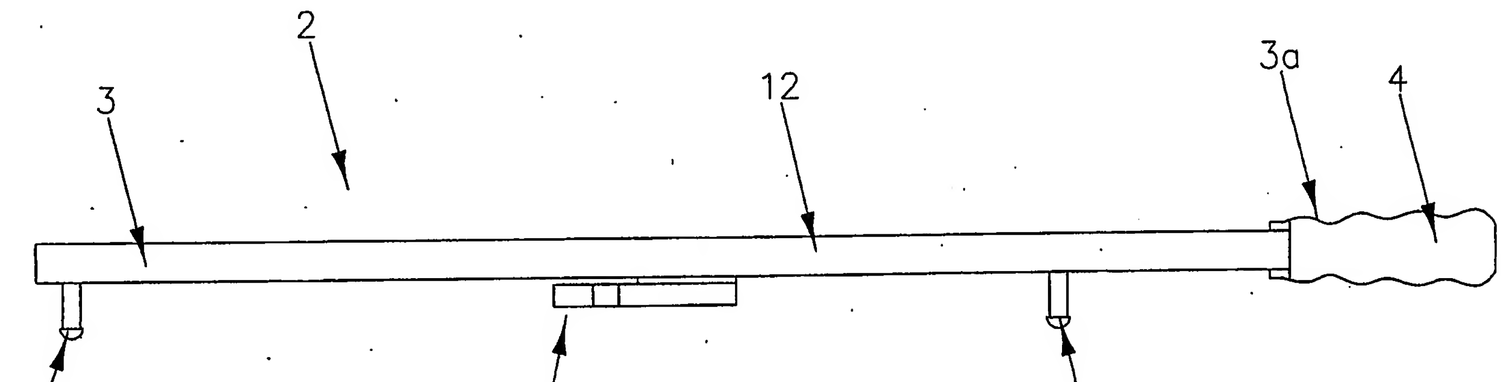


Fig.1.

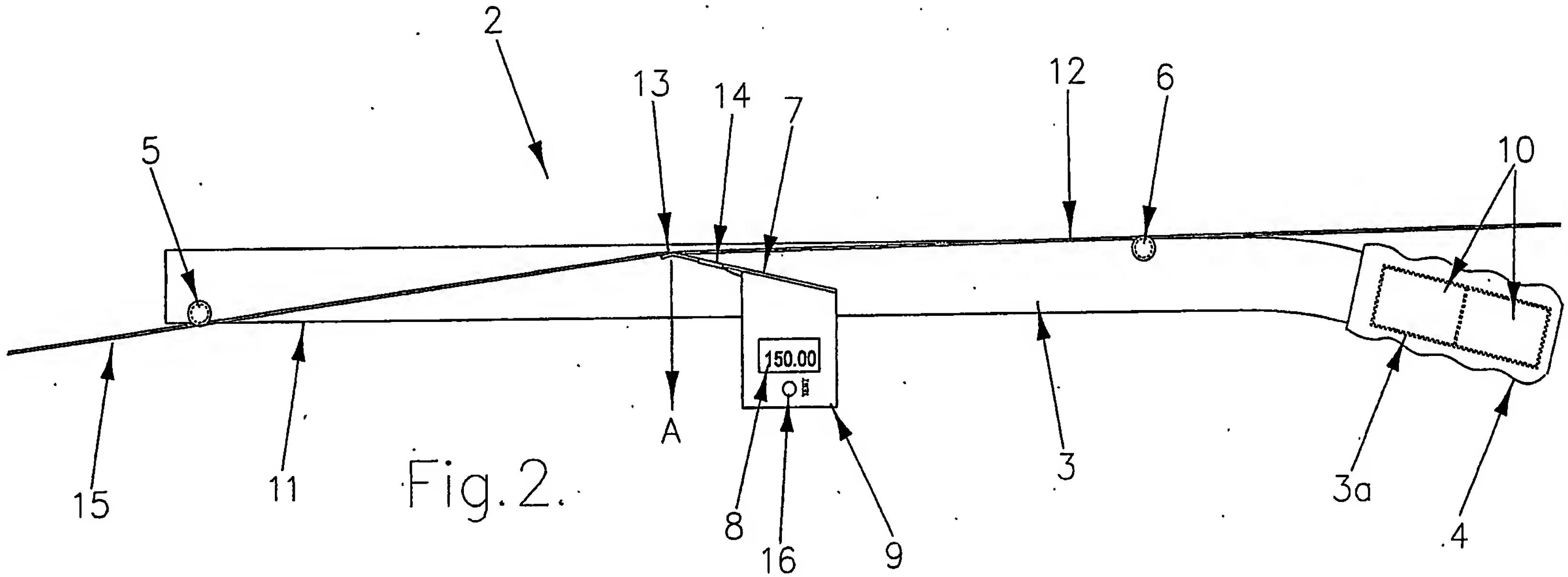


Fig.2.

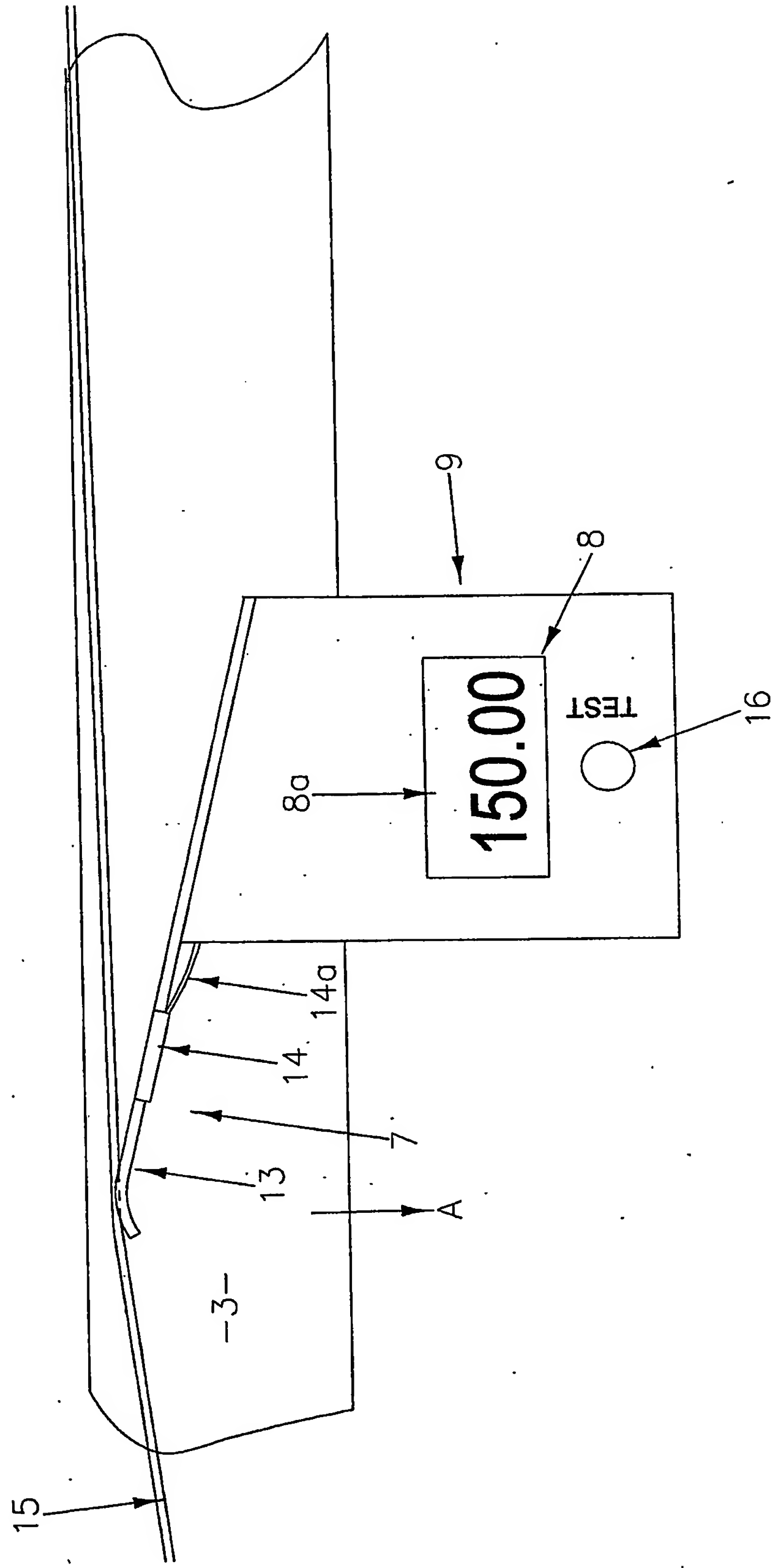


Fig. 3.